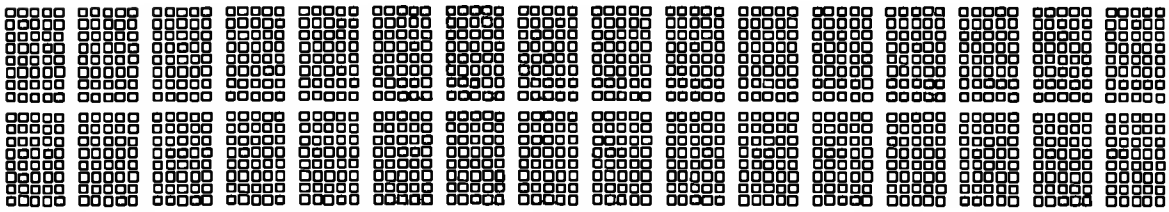
APPLICATION NOTES

STANDARD ALPHANUMERIC MODULES



STANDISH IND.

STANDISH LCD DIVISION
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G. C. H. 9343 REV. 1.1

ALPHANUMERIC DOT MATRIX LCD MODULES

STANDISH LCD
TEL: (414) 648-1000

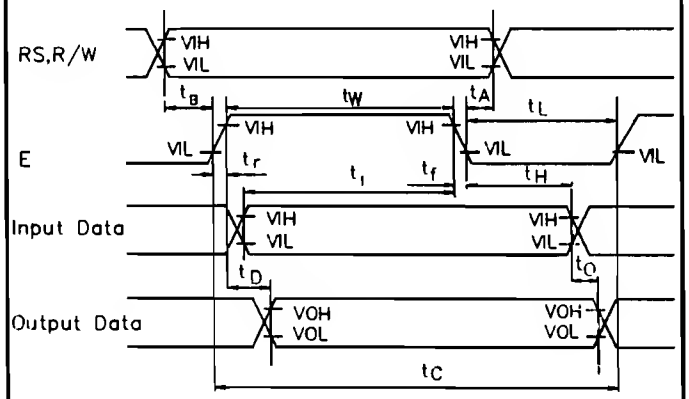
DEFINITION OF TERMINALS

PIN ON.	SYMBOL	FUNCTION
1.	Vss	Ground terminal of module.
2.	Vdd	Supply terminal of module,+5V.
3.	Vo	Power supply for Liquid Crystal Drive
4.	RS	Register Select RS = 0...Instruction Register. RS = 1...Data Register.
5.	R/W	Read/Write R/W = 1...Read R/W = 0...Write
6.	E	Enable
7~14.	DBO~DB7	Bi-directional Data Bus. Data transfer is performed once, thru DB0-DB7, when using 8-bit data path; or twice, thru DB4-DB7, when using a 4-bit data path.

OPERATING SPECIFICATIONS

	STANDARD TEMP
Operating temperature range	0°C to +50°C
Storage temperature range	-40°C to +70°C
Operating relative humidity	90% R.H. Max (Non-condensing)

TIMING DIAGRAM



ELECTRICAL CHARACTERISTICS (Ta = +25°C)

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply Voltage	VDD		4.5	5.0	5.5	V
LCD Drive Voltage Standard Temperature Supertwist (STN) Display	VDD-Vo		— —	3.9 7.5	— —	V V
Supply Current 8 x 1, 16 x 1 16 x 2 20 x 2 20 x 4, 40 x 2	IDD	VDD=5V Vo = 0V MIN	— — — —	1.0 1.0 1.5 2.5	2.0 3.0 3.0 4.0	mA mA mA mA
Input Voltage [1]	VIL VIH		0.0 2.2	— —	0.6 VDD	V V
Output Voltage [2]	V0L V0H	I0L = 1.6 mA I0H = 0.2 mA	— 2.4	— —	0.4 —	V V
Enable Cycle Time	tC		1.0	—	—	µS
Enable Pulse Width High Level Low Level	 tW tL		 450 450	 — —	 — —	 nS nS
E Rise Time	tr		—	—	25	nS
E Fall Time	tr		—	—	25	nS
Set-up Time	tB		140	—	—	nS
Data Set-up Time	tI		195	—	—	nS
Data Delay Time	tD		—	—	320	nS
Address Hold Time	tA		10	—	—	nS
Hold Time Input Data Output Data	 tH t0		 10 20	 — —	 — —	 nS nS
LED Current 20 x 2	I LED		—	60	80	mA

Note: 1. Applies to DB0 - DB7,E,RS and R/W
2. Applies to DB0 - DB7.

ALPHANUMERIC DOT MATRIX LCD MODULES

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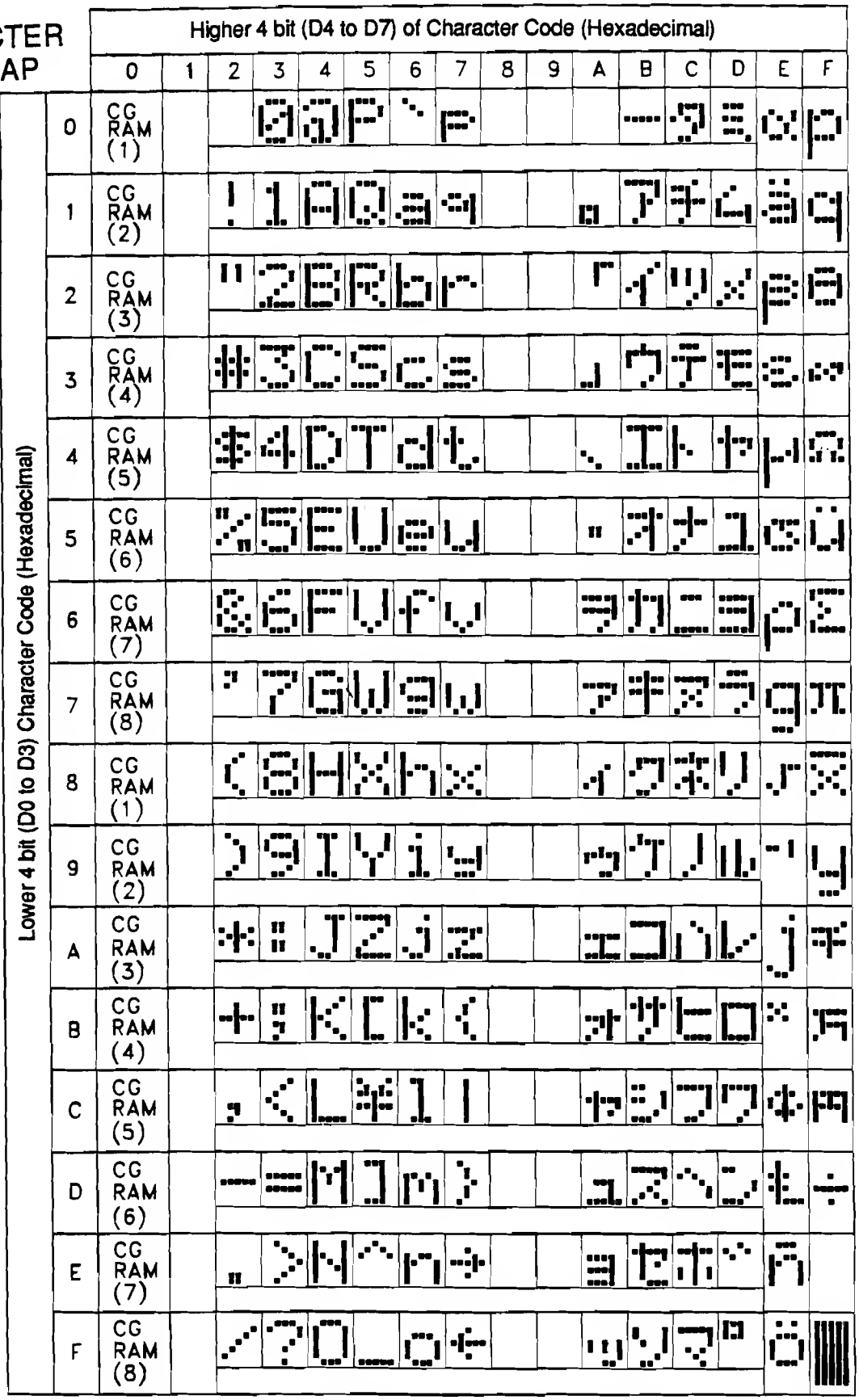
CHARACTER CODE MAP



NOTE: SOME PATTERNS WITH CHARACTERS ABOVE "EøH" (11100000) ARE FOR 5 x 10 DOT MATRIX CHARACTER FONT.

INSTRUCTION SET

	CODE											
INSTRUCTION	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	DESCRIPTION	TYPICAL EXECUTION TIME
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears all display and returns the cursor to the home position (Address 0) Sets I/D=1 of Entry Mode	1.64 ms
Return Home	0	0	0	0	0	0	0	0	1	●	Returns the cursor to the home position (Address 0). Also returns the display being shifted to the original position. DD RAM contents remain unchanged. Set DD RAM addresses to zero.	1.64 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets the cursor move direction and specifies or not to shift the display. These operations are performed during data write and read of DD RAM/CG RAM	40 µs
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Sets ON/OFF all display (D), cursor ON/OFF (C), and blink of cursor position character (B). 1=ON, 0=OFF.	40 µs
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	●	●	Moves the cursor and shifts the display without changing DD RAM contents.	40 µs
Function Set	0	0	0	0	1	DL	N	F	●	●	Sets interface data length (DL) number of display linee (N) and character font (F).	40 µs
Set the CG RAM Address	0	0	0	1	MSB	ACG				LSB	Sets the CG RAM address. CG RAM data is sent and received after this setting.	40 µs
Set the DD RAM Address	0	0	1	MSB	ADD					LSB	Sets the DD RAM address. DD RAM data is sent and received after this setting.	40 µs
Read Busy Flag And Address	0	1	BF	MSB	AC					LSB	Reads Busy Flag (BF) indicating internal operation is being performed and reade address counter contents.	40 µs
Write Data to CG or DD RAM	1	0	MSB							LSB	Writes data into DD RAM or CG RAM.	40 µs
Read Data From CG or DD RAM	1	1	MSB							LSB	Reads data from DD RAM or CG RAM	40 µs

S =1: Accompanies display shift when data is written
I/D =1: Increment
I/D =0: Decrement
S/C =1: Display shift
S/C =0: Cursor move
R/L =1: Shift to the right
R/L =0: Shift to the left
BF =1: Internally operating
BF =0: Can accept instruction
DL =1: 8 bits
DL =0:4 bits
N =1:2 lines
N =0:1 line
F =1:5x10 dots
F =0:5x7 dots

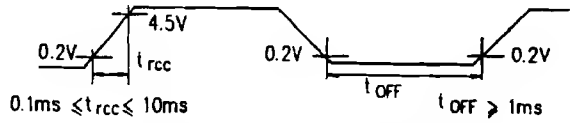
DD RAM: Display data RAM
CG RAM: Character generator RAM
ACG: CG RAM address
ADD: DD RAM address corresponds to cursor address
AC: Address counter used for both DD & CG RAM address
● Don't Care

INITIALIZATION

The module automatically performs Initialization when powered on (using internal reset circuit). The following instructions are executed during initializatiion:

1. CLEAR DISPLAY
   The Busy Flag is kept in the Busy State (BF=1) until initialization ends. The time is 15 ms.
2. Function Set..... DL= 1: 8-bits long interface data
   N = ø: 1 line display
3. DISPLAY ON/OFF CONTROL.....D = ø: Display OFF
   C = ø: Cursor OFF
   B = ø: Blink OFF
4. ENTRY MODE SET ..... I/D = 1: +1 (INCREMENT)
   S= ø: No SHIFT
5. DD RAM IS SELECTED
   Power On Initialization depends on rise time of the supply when it is turned on. The following time relationship must be satisfied.

ITEM	SYMBOL	STANDARD TIME MIN	TYP	MAX	UNIT
Power Supply Rise Time	t_{rcc}	0.1	—	10	ms
Power Supply Off Time	t_{OFF}	1.0	—	—	ms



Power On Timing Diagram

When the above power supply condition is not satisfied, the internal reset circuitry does not operate correctly. In this case, perform the needed initialization 15 msec after power is applied by sending the 8-bit function set instruction three times with the delay interval shown below. (NOTE: Busy flag is not valid until after this sequence is performed.)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	X	X	X	X
			—wait at least 4.1 msec—						
0	0	0	0	1	1	X	X	X	X
			—wait at least 100 µsec—						
0	0	0	0	1	1	X	X	X	X

Once completed, the module enters 8-bit data mode. For a 4-bit data interface, follow the above sequence with the 4-bit data length instruction.

INTERFACING TO THE HOST SYSTEM

The module's data bus (DB0-DB7) can be connected directly to the data bus of a 6800 style microprocessor. R/W gets connected to R/W of the MPU and RS gets connected to the least significant bit of the address bus. The E signal is formed by AND-ing the ø2 and VMA signals. The level of RS must be valid at least 140 nSec prior to E going high.

Additional logic is required for systems with separate READ and WRITE signals. In the circuit shown below, R1 and C1 are added to delay the rising edge of the E pulse. These two components should be selected such that E goes high no less than 140 nSec after RS becomes valid and stays high for no less than 450 nSec.

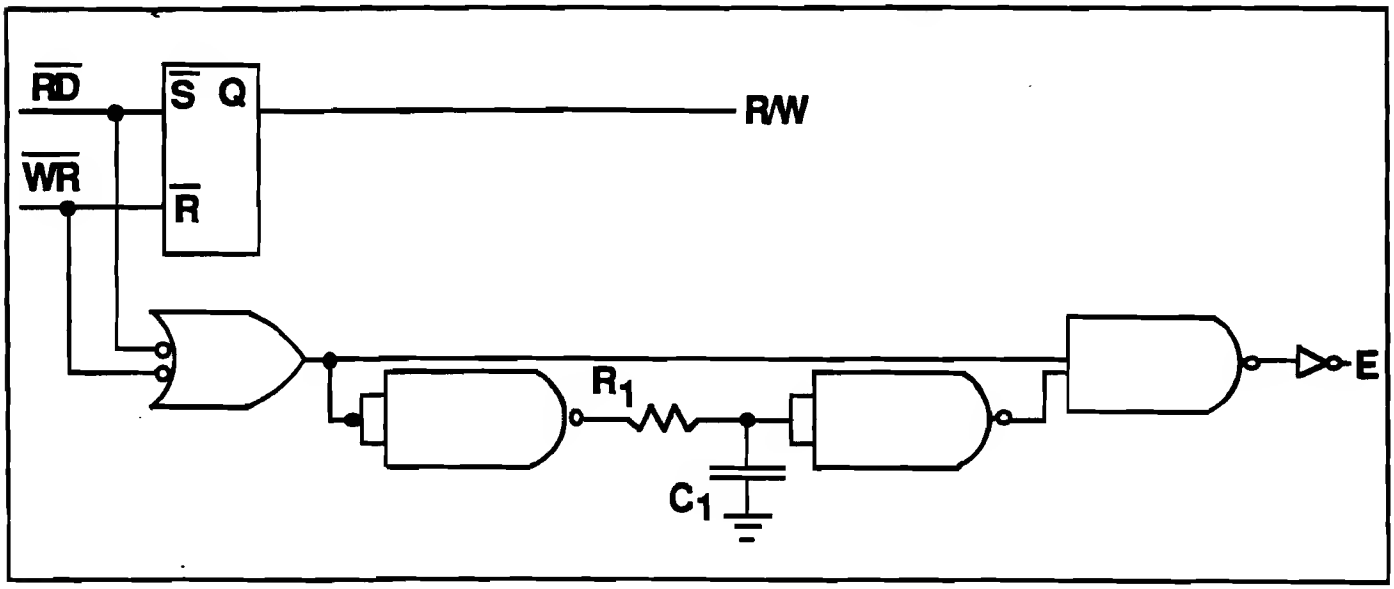
CHARACTER GENERATOR RAM (CG RAM)

The character generator RAM is the RAM available to the programmer for generating unique character patterns not found in the CG ROM. Eight 5 x 7 dot character (or four 5 x 10 dot character) patterns may be programmed. Write the character codes listed in the left edge of the character code map to display the patterns stored in CG RAM.

The table on page 5 shows the relation between CG RAM address, data, and display patterns. CG RAM data bits that are not used for character pattern display (indicated by "*") can be used as general data RAM.

CHARACTER GENERATOR ROM (CG ROM)

The character generator ROM generates 5 x 7 (or 5 x 10 where applicable) dot patterns from 8-bit character codes. See the character code map for pattern definitions.



RECOMMENDED POWER-UP SEQUENCE

Step	Operation	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1.	Read Busy Flag	0	1	BF	←			AC			→
2.	Function Set	0	0	0	0	1	DL	N	0	*	*
3.	Clear Display	0	0	0	0	0	0	0	0	0	1
4.	Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S
5.	Display On/Off Control	0	0	0	0	0	0	1	D	C	B

* (Dont Care)

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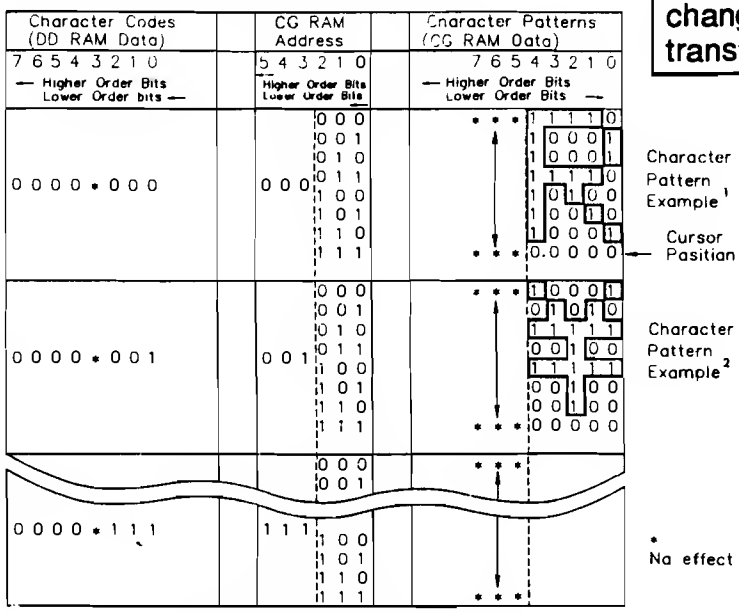
HANDLING PRECAUTIONS:

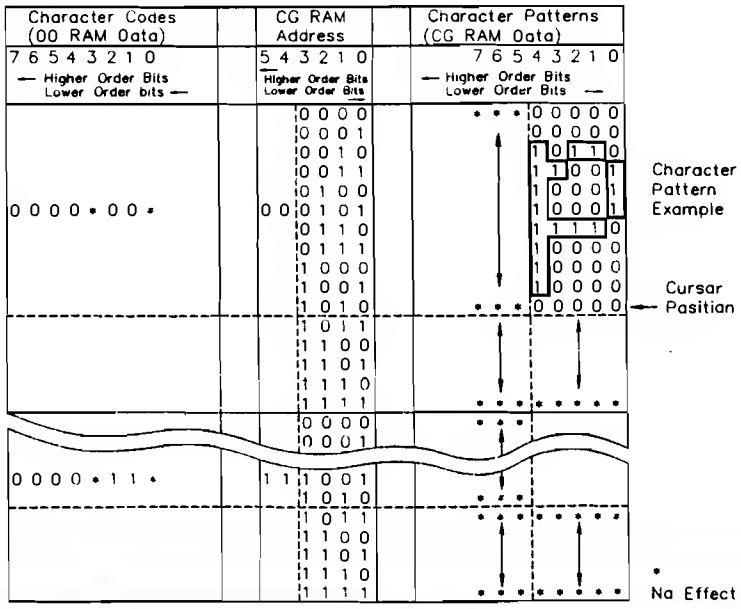
Standish LCD MODULES contain CMOS devices and must be handled correctly to prevent damage. Do not make any circuit changes under "Power On" condition as high transients may cause permanent damage.

DOT CHARACTER PATTERNS

For 5 x7 Dot Character Patterns



For 5 x 10 Dot Character Patterns

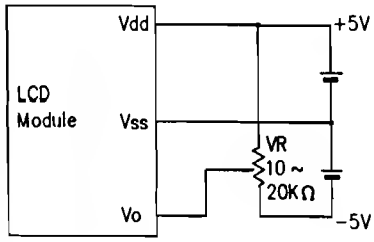


NOTE:
Character code bits 0,2 correspond to CG RAM address bits 3,5
(3 bits : 8 types)

NOTE:
Character code bits 1,2 correspond to CG RAM address bits 4,5
(2 bits : 4 types)

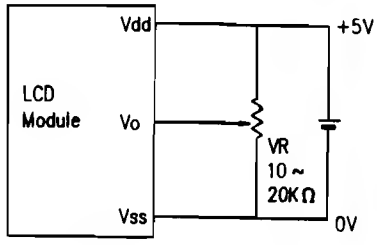
POWER SUPPLY REQUIREMENTS

• Supertwist (STN) Display



$10K\Omega \leqslant Vr \leqslant 20K\Omega$
for both power supply requirements'

• Standard Temperature



RAM LOCATIONS FOR ALPHANUMERIC MODULES

	1	2	3	4	5	6	7	8	9	10	—	30	31	32	33	34	35	36	37	38	39	40
DD RAM	00	01	02	03	04	05	06	07	08	09	—	1D	1E	1F	20	21	22	23	24	25	26	27
DD RAM	40	41	42	43	44	45	46	47	48	49	—	5D	5E	5F	60	61	62	63	64	65	66	67

INTERNAL ADDRESS COUNTING FOR AN HD44780

PHYSICAL LOCATION		1	2	3	4	5	6	7	8
DD RAM	LINE 1	00	01	02	03	04	05	06	07

MDDULE USED FDR: **SIM81**

PHYSICAL LDCATIDN		1	2	3	4	5	6	7	8		9	10	11	12	13	14	15	16
DD RAM	LINE 1	00	01	02	03	04	05	06	07		40	41	42	43	44	45	46	47

MODULES USED FOR: **SIM161, C, E, & F**

PHYSICAL LDCATIDN		1	2	3	4	5	6	7	8	8	10	11	12	13	14	15	16
DD RAM	LINE 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F

MDDULE USED FDR: **SIM161B**

PHYSICAL LOCATIDN		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DD RAM	LINE 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
DD RAM	LINE 2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

MDDULES USED FDR: **SIM162, B, C, E, F, G, H, J, & K**

PHYSICAL LDCATIDN		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DD RAM	LINE 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
DD RAM	LINE 2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
DD RAM	LINE 3	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
DD RAM	LINE 4	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F

MODULE USED FDR: **SIM164**

PHYSICAL LDCATIDN		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	18	20
DD RAM	LINE 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13

MDDULES USED FDR: **SIM201, B, C**

PHYSICAL LOCATION		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DD RAM	LINE 1	00	01	02	03	04	05	06	07	08	09	40	41	42	43	44	45	46	47	48	49

MDDULES USED FDR: **SIM201D**

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RAM LOCATIONS cont.

PHYSICAL LOCATION		1	2	3	4	5	6	7	8	8	10	11	12	13	14	15	16	17	18	18	20
DD RAM	LINE 1	00	01	02	03	04	05	06	07	08	09	0A	08	0C	0D	0E	0F	10	11	12	13
DD RAM	LINE 2	40	41	42	43	44	45	46	47	48	49	4A	48	4C	4D	4E	4F	50	51	52	53

MODULES USED FOR: **SIM202, B, C, D**

PHYSICAL LOCATION		1	2	3	4	5	6	7	8	8	10	11	12	13	14	15	16	17	18	19	20
DD RAM	LINE 1	00	01	02	03	04	05	06	07	08	09	0A	08	0C	0D	0E	0F	10	11	12	13
DD RAM	LINE 2	40	41	42	43	44	45	46	47	48	48	4A	48	4C	4D	4E	4F	50	51	52	53
DD RAM	LINE 3	14	15	16	17	18	18	1A	18	1C	1D	1E	1F	20	21	22	23	24	25	26	27
DD RAM	LINE 4	54	55	56	57	58	59	5A	58	5C	5D	5E	5F	60	61	62	63	64	65	66	67

MODULES USED FOR: **SIM204, C, D**

PL		1	2	3	4	5	6	7	8	8	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
DD	L1	00	01	02	03	04	05	06	07	08	08	0A	08	0C	0D	0E	0F	10	11	12	13	14	15	16	17

MODULES USED FOR: **SIM241, B**

PHYSICAL LOCATION		1	2	3	4	5	6	7	8	9	10	11	12
DD RAM	1 - 12	00	01	02	03	04	05	06	07	08	09	0A	08
DD RAM	13 - 24	40	41	42	43	44	45	46	47	48	49	4A	48

MODULE USED FOR: **SIM241B**

PL		1	2	3	4	5	6	7	8	8	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
DD	L1	00	01	02	03	04	05	06	07	08	08	0A	08	0C	0D	0E	0F	10	11	12	13	14	15	16	17
DD	L2	40	41	42	43	44	45	46	47	48	48	4A	48	4C	4D	4E	4F	50	51	52	53	54	55	56	57

MODULES USED FOR: **SIM242, B**

PHYSICAL LOCATION		1	2	3	4	5	6	7	8	8	10	11	12	13	14	15	16	17	18	19	20
DD RAM	LINE 1	00	01	02	03	04	05	06	07	08	09	0A	08	0C	0D	0E	0F	10	11	12	13
DD RAM	L1 CONT	40	41	42	43	44	45	46	47	48	49	4A	48	4C	4D	4E	4F	50	51	52	53

MODULE USED FOR: **SIM401**

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RAM LOCATIONS cont.

PHYSICAL LOCATION		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DD RAM	L 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
DD RAM	L 2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53
PHYSICAL LOCATION		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
DD RAM	L 1	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27
DD RAM	L 2	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67

MODULE USED FOR: **SIM402**

ENABLE 1	PL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DD RAM	LINE 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
DD RAM	LINE 3	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53
	PL	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
DD RAM	LINE 1	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27
DD RAM	LINE 3	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67
ENABLE 2	PL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DD RAM	LINE 2	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
DD RAM	LINE 4	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53
	PL	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
DD RAM	LINE 2	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27
DD RAM	LINE 4	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67

MODULE USED FOR: **SIM404**

PHYSICAL LOCATION (PL): The actual character that is seen by the user, numbered left to right.

DD RAM (DD): The controllers address of the character.

L1: The first line of characters.

L2: The second line of characters.

LINE3 (L3): The third line of characters.

LINE4 (L4): The fourth line of characters.

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ODULES	TLC	THN	THW	THN-EHT	SLC	SHW	SHC	EL	01	02	03	04	CHAR. FONT	CHAR. HEIGHT (mm)	BASE PART#
8 x 1	X	X	X	X	X	X	X					X	5 x 8	10.75	SIM81
16 x 1	X	X	X	X	X	X		X	X			X	5 x 8	6.30	SIM161
16 x 1	X	X	X	X	X	X						X	5 x 8	9.22	SIM161B
16 x 1	X	X	X	X	X	X	X	X	X			X	5 x 11	8.70	SIM161C
16 x 1		X	X	X	X	X	X					X	5 x 8	12.70	SIM161E
16 x 1	X	X	X	X	X	X	X					X	5 x 8	14.54	SIM161F
16 x 2	X	X	X	X	X	X		X	X			X	5 x 8	5.55	SIM162
16 x 2	X	X	X	X	X	X						X	5 x 8	9.22	SIM162B
16 x 2	X	X	X	X	X	X		X				X	5 x 11	9.30	SIM162C
16 x 2	X		X	X	X	X						X	5 x 8	9.22	SIM162E
16 x 2	X		X	X	X	X		X				X	5 x 8	5.55	SIM162F
16 x 2	X		X	X	X	X		X				X	5 x 8	5.55	SIM162G
16 x 2	X		X	X	X	X		X	X			X	5 x 8	5.55	SIM162H
16 x 2	X		X	X	X	X						X	5 x 8	5.75	SIM162J
16 x 2	X		X	X	X	X						X	5 x 8	4.00	SIM162K
16 x 4	X		X	X	X	X						X	5 x 8	4.75	SIM164
20 x 1	X	X	X	X	X	X						X	5 x 8	9.22	SIM201
20 x 1	X	X	X	X	X	X	X					X	5 x 8	12.70	SIM201B
20 x 1	X	X	X	X	X	X	X	X				X	5 x 8	11.50	SIM201C
20 x 1	X	X	X	X		X	X					X	5 x 8	14.54	SIM201D
20 x 2	X	X	X	X	X	X						X	5 x 8	5.55	SIM202
20 x 2		X			X	X	X					X	5 x 8	9.22	SIM202B
20 x 2			X	X	X	X	X				X		5 x 8	12.70	SIM202C
20 x 2		X			X	X	X					X	5 x 8	9.52	SIM202D
20 x 4	X	X	X	X	X	X		X				X	5 x 8	4.70	SIM204
20 x 4		X	X	X	X	X	X					X	5 x 8	9.22	SIM204B
20 x 4		X	X	X		X	X				X		5 x 8	12.70	SIM204C
20 x 4	X	X	X	X	X	X						X	5 x 8	4.03	SIM204D
24 x 1	X	X	X	X	X	X	X	X		X			5 x 11	8.70	SIM241
24 x 1	X	X	X	X	X			X				X	5 x 8	6.30	SIM241B
24 x 2	X	X	X	X	X	X		X				X	5 x 8	5.15	SIM242
24 x 2	X	X	X	X	X	X	X						5 x 8	8.70	SIM242B
40 x 1	X	X	X	X	X	X	X		X				5 x 8	6.30	SIM401
40 x 2	X	X	X	X	X	X		X				X	5 x 8	5.50	SIM402
40 x 4	X	X	X	X	X	X	X	X				X	5 x 8	5.50	SIM404

*OPERATE TEMPERATURE RANGES:

TN LCD = TLC -5 to +50oC
THN -10 to +60oC
THW -20 to +70oC
THN-EHT -30 to +80oC
STN LCD = SLC 0 to 50oC
SHC 0 to 50oC
SHW -20 to +70oC

THE NORMAL LED BACKLIGHT COLOR IS GREEN, OTHER COLORS ARE RED, YELLOW REQUIRE A MINIMUM 1000 PIECE ORDER
THE STANDARD EL COLOR IS BLUE-GREEN. THE COLOR CAN BE SHIFTED TO GREEN, YELLOW, OR LIGHT RED BY AN ADDITIONAL FILTER

	8:1 MULTIPLEXING				16:1 MULTIPLEXING				
	TN		STN		TN			STN	
	TLC	OTHER	SLC	SHW	TLC	THH	OTHER	SLC	SHW
-20°C	-----	7.7	-----	9.5	-----	-----	8.50	-----	10.00
-10°C	3.7	6.7	5.35	9.4	-----	8.20	8.20	5.08	9.80
0°C	3.5	6.6	5.20	8.8	5.00	7.90	7.90	4.80	9.50
+25°C	3.4	6.4	4.85	7.4	4.60	7.40	7.40	4.65	9.35
+50°C	2.4	4.8	4.70	7.1	4.10	6.80	6.80	4.35	9.00

These are typical values. Actual values may vary from model to model due to different bias resistors used

LED BACKLIGHT CURRENT DRAIN BY MODULE AND BACKLIGHT STYLE

BASIC	LED 01		LED 02		LED 03		LE 04						
MODULE PART	FORWARD CURRENT (mA) AT 4.1V						OVERALL SIZE (mm)	BOX SIZE (mm)	ACTIVE SIZE (mm)	NUMBER OF	FORWARD CURRENT AT 4.1V		RES.
NUMBER	TYP	MAX	TYP	MAX	TYP	MAX	L1 X W X H	L2 X W	LE X WE	LED'S	TYP	MAX	OPT.
SIM81							73 x 22.8 x 5	66 x 22.8	64 x 17.8	2 x 9	60	180	10.00Ω
SIM161	30	40					72.5 x 16.5 x 3.8	70 x 18.5	65 x 13.8	2 x 10	100	200	9.00Ω
SIM161B							104 x 18 x 4.8	100 x 18	66 x 12	2 x 32	160	320	5.625Ω
SIM161C	30	40					72.5 x 18.5 x 3.8	70 x 18.5	65 x 13.8	2 x 10	100	200	8.00Ω
SIM161E							140 x 28.5 x 3.6	133 x 26.5	119.4 x 18.7	2 x 17	170	340	5.29Ω
SIM161F							138 x 26 x 3.8	126 x 26	120 x 23	3 x 17	255	510	3.53Ω
SIM162	30	40					72 x 20.5 x 3.8	67 x 20.5	61 x 15.8	2 x 9	60	180	10.00Ω
SIM162B							110 x 285 x 4.6	106 x 26	101 x 23	2 x 21	210	420	4.29Ω
SIM162C			85	110			123 x 27.5 x 58	116 x 27.5	114.5 x 23	2 x 24	240	480	3.75Ω
SIM162E							110 x 28 x 4.6	106 x 28	101 x 23	2 x 21	210	420	4.29Ω
SIM162F	30	40					72 x 20.5 x 3.8	67 x 20.5	61 x 15.6	2 x 9	60	180	10.00Ω
SIM162G	30	40					72 x 20.5 x 3.8	67 x 20.5	61 x 15.6	2 x 6	80	180	10.00Ω
SIM162H	30	40					72 x 20.5 x 3.8	67 x 20.5	61 x 15.6	2 x 6	60	180	10.00Ω
SIM162J							75 x 21 x 3.6	70 x 21	63.5 x 15.6	2 x 6	80	160	11.25Ω
SIM162K							57 x 18.5 x 3.8	52 x 16.5	48.6 x 12	2 x 7	70	140	12.675Ω
IM164							64 x 35 x 3.8	61.6 x 35	61.8 x 25.2	2 x 9	60	160	10.00Ω
SIM201							137 x 18 x 5	132 x 18	124 x 14	2 x 18	180	360	5.00Ω
SIM201B			115	150			166 x 25.8 x 5	160 x 25.6	147 x 16	2 x 22	220	440	4.09Ω
SIM201C							163.6 x 22 x 4.8	156.6 x 22	155.6 x 18	2 x 34	340	680	2.65Ω
SIM201D							158.6 x 26 x 3.8	158.6 x 26	149 x 23	3 x 21	315	630	2.66Ω
SIM202			60	80			94 x 24 x 4	60 x 24	84 x 18	2 x 18	160	360	5.00Ω
SIM202B							134 x 26 x 5	129 x 28	124 x 23	3 x 18	270	540	3.33Ω
SIM202C					225	300	166 x 42 x 4.5	160 x 42	147 x 36	4 x 21	420	840	2.14Ω
SIM202D							158.6 x 29 x 3.6	158.6 x 29	146 x 23	3 x 21	315	630	2.66Ω
SIM204			70	90			96.5 x 31.5 x 3.7	95 x 31.5	81 x 26	2 x 24	240	480	3.75Ω
SIM204B							131 x 47 x 5	126 x 47	121 x 41.5	6 x 16	540	1080	1.67Ω
SIM204C					225	300	----------	----------	----------	----	---	---	---
SIM204D							75 x 26.6 x 3.8	73.4 x 26.6	60 x 22	3 x 9	135	270	6.67Ω
SIM241							110 x 16.5 x 4.5	106 x 16.6	100 x 13.6	2 x 16	150	300	6.00Ω
SIM241B							110 x 18.5 x 4.5	106 x 16.5	100 x 13.6	2 x 16	150	300	6.00Ω
SIM242			70	60			103.5 x 20.5 x 4	101 x 20.5	94 x 15.8	2 x 14	140	280	6.43Ω
SIM242B							175 x 27.8 x 3.8	167.8 x 27.8	160 x 23.6	3 x 22	330	660	2.73Ω
SIM401							----------	----------	----------	-----	---	---	-----
SIM402							163.6 x 22 x 4.6	159.6 x 22	155.6 x 16	2 x 34	340	680	2.65Ω
SIM404							172 x 33 x 5.0	168 x 33	163 x 28	2 x 36	360	720	2.50Ω

File no: D:\DOCUMENT\LEDAMP.DRN
Last Updated 27 August 1993

The recommended operation, is a 5v supply, with the correct current limiting resistor shown.
The resistor value shown is optimum.